



# UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE  
United States Patent and Trademark Office  
Address: COMMISSIONER FOR PATENTS  
P.O. Box 1450  
Alexandria, Virginia 22313-1450  
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/659,086	09/09/2003	Thomas E. Strangman	H0001542D1	2727

7590 03/04/2004

Honeywell International, Inc.  
Law Dept. AB2  
P.O. Box 2245  
Morristown, NJ 07962-9806

EXAMINER
----------

BAREFORD, KATHERINE A

ART UNIT	PAPER NUMBER
----------	--------------

1762

DATE MAILED: 03/04/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b>	<b>Applicant(s)</b>	
	10/659,086	STRANGMAN ET AL.	
	<b>Examiner</b>	<b>Art Unit</b>	
	Katherine A. Bareford	1762	

**-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --**

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 09 September 2003.
- 2a) ☐ This action is **FINAL**.
- 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-54 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 29-31 and 33-54 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

*Claims 1-28 and 32 are cancelled.*

**Application Papers**

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 09 September 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All    b) ☐ Some \*    c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                        | 4) <input type="checkbox"/> Interview Summary (PTO-413)                     |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)               | Paper No(s)/Mail Date. _____  |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>9/03</u> .  | 6) <input type="checkbox"/> Other: _____                                    |

### DETAILED ACTION

1. The Examiner notes the preliminary amendment filed Sept. 9, 2003, canceling claims 1-28 and 32, amending claims 29-31 and 33-39 and providing new claims 40-54.

#### *Specification*

2. The disclosure is objected to because of the following informalities: at page 1, the reference to parent application 09/932,246 should be updated to indicate that it is now US Patent No. 6,656,600.

Appropriate correction is required.

#### *Claims*

3. The Examiner notes that in independent claims 29, 42 and 50, the claims require "depositing a layer of thermal barrier material onto the engine surface that will be exposed" (claim 29), "depositing a layer of thermal barrier material on the gas turbine engine surface" (claim 42) and "depositing a layer of thermal barrier material on the engine surface" (claim 50). The Examiner understands this to include a single layer of material as the thermal barrier material layer or a multiple layer of material (providing for example, that the thermal barrier material can be deposited as a ceramic layer on a bond coat layer) as the thermal barrier material layer, because as shown by claim 49, the "thermal barrier material" can include a bond coat material layer.

Art Unit: 1762

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 29-31, 34, 35, 38, 39, 41 and 50-52 are rejected under 35 U.S.C. 102(b) as being anticipated by Bruce et al (US 5683825).

Bruce teaches a method of forming a thermal barrier coating on a gas turbine engine surface that will be exposed to the flow of burning engine gas as fuel droplets. Column 3, lines 35-50. The method comprises depositing a layer of thermal barrier material onto the engine surface that will be exposed. Column 4, line 15 through column 5, line 40. The thermal barrier layer includes a bond coating and a thermal barrier coating. Column 4, line 45 through column 5, line 40 and figure 2. Then a layer of material which can be alumina is applied to the thermal barrier layer. Figure 2 and column 5, line 50 through column 6, line 15. This alumina will inherently act as a carbon deposit inhibiting material (CDIM), because it is of a material (alumina) and thickness claimed as providing inhibition (see claim 34, claim 52 and original claim 33). Column 6, lines 5-15.

Claim 30: the thermal barrier material comprises a ceramic. Column 5, lines 20-35 and figure 2.

Art Unit: 1762

Claim 31: the layer of thermal barrier material can form a thickness in the range of 5 to 100 mils. Column 4, line 55-60 and column 5, lines 25-35 (the bond coat layer and the ceramic layer 30 combine to a range of 95-425 microns or approximately 4 to 17 mils).

Claim 34: the CDIM is deposited in a thickness of 20-80 microns (approx. 0.75-3.15 mil). Column 6, lines 10-15.

Claim 35: the CDIM thickness can be 3.15 mil. Column 6, lines 10-15.

Claims 38, 39: the thermal barrier material and the CDIM can be deposited by electron beam physical vapor deposition. Column 5, lines 25-40 and column 6, lines 10-15.

Claim 41: the thermal barrier material can comprise yttria stabilized zirconia. Column 5, lines 20-25.

Claim 50: a method of applying a thermal barrier coating on a gas turbine engine surface is taught. Column 3, lines 35-50. The method can consist of depositing a layer of thermal barrier material onto the engine surface that will be exposed. Column 4, line 15 through column 5, line 40. The thermal barrier layer includes a bond coating and a thermal barrier coating. Column 4, line 45 through column 5, line 40 and figure 2. Then a layer of material which can be alumina is applied to the thermal barrier layer. Figure 2 and column 5, line 50 through column 6, line 15. This alumina will inherently act as a carbon deposit inhibiting material (CDIM), because it is of a material (alumina) and thickness claimed as providing inhibition (see claim 34, claim 52 and original claim 33). Column 6, lines 5-15.

Claim 51: the layer of thermal barrier material can form a thickness in the range of 5 to 100 mils. Column 4, lines 55-60 and column 5, lines 25-35 (the bond coat layer and the

Art Unit: 1762

ceramic layer 30 combine to a range of 95-425 microns or approximately 4 to 17 mils). The CDIM is deposited in a thickness of 20-80 microns (approx. 0.75-3.15 mil). Column 6, lines 10-15.

Claim 52: the thermal barrier coating can comprise a deposited ceramic material. Column 5, lines 20-35. The CDIM can comprise alumina. Column 6, lines 5-15.

6. Claims 29, 30, 33, 36, 38-41, 50 and 52-54 are rejected under 35 U.S.C. 102(e) as being anticipated by Subramanian (US 6258467).

Subramanian teaches a method of forming a thermal barrier coating on a gas turbine engine surface that will be exposed to the flow of burning engine gas a fuel droplets. Column 1, lines 10-20. The method comprises depositing a layer of thermal barrier material onto the engine surface that will be exposed. Column 1, lines 10-20, column 4, lines 30 through column 5, line 30 and column 7, lines 10-20. The thermal barrier layer includes a bond coating and a thermal barrier coating. Column 4, line 50 through column 5, line 25, column 7, lines 10-20 and figure 6. Then a layer of material which can include a lanthanum oxide is applied to the thermal barrier layer. Figure 6, column 5, lines 25-40 and column 7, lines 10-20 (the material of Subramanian can be a lanthanum oxide bearing material, which reads on the layer as required—note that materials other than the lanthanum oxide alone can be present). This lanthanum oxide will inherently act as a carbon deposit inhibiting material (CDIM), because it is of a material (lanthanum oxide) claimed as providing inhibition (see claim 33). Column 5, lines 20-35.

Art Unit: 1762

Claim 30: the thermal barrier material comprises a ceramic. Column 5, lines 1-20 and column 7, lines 10-20.

Claim 33: the CDIM can comprise a lanthanum oxide. Column 5, lines 25-40 and column 7, lines 10-20.

Claim 36: the CDIM and thermal barrier material can be applied by plasma spraying. Column 7, lines 10-20 and column 5, lines 1-20.

Claims 38, 39: the thermal barrier material and the CDIM can be deposited by electron beam physical vapor deposition. Column 5, lines 1-20 and column 7, lines 10-20.

Claim 40: the coating can consist essentially of a layer of stabilized zirconia disposed on the gas turbine engine surface (the bond coat application is optional), followed by a refractory oxide layer comprising lanthanum oxide directly on the zirconia layer. Column 4, line 40 through column 5, line 40, column 7, lines 10-20 and figure 6.

Claim 41: the thermal barrier material can comprise yttria stabilized zirconia. Column 5, lines 1-20 and column 7, lines 10-20.

Claim 50: a method of applying a thermal barrier coating on a gas turbine engine surface is taught. Column 1, lines 10-20. The method can consist of depositing a layer of thermal barrier material onto the engine surface that will be exposed. Column 1, lines 10-20, column 4, lines 30 through column 5, line 30 and column 7, lines 10-20. The thermal barrier layer includes a bond coating and a thermal barrier coating. Column 4, line 50 through column 5, line 25, column 7, lines 10-20 and figure 6. Then a layer of material which can comprise lanthanum oxide is applied to the thermal barrier layer. Figure 6, column 5, lines 25-40 and

Art Unit: 1762

column 7, lines 10-20. This lanthanum oxide will inherently act as a carbon deposit inhibiting material (CDIM), because it is of a material (lanthanum oxide) and thickness claimed as providing inhibition (see claim 33). Column 5, lines 20-35.

Claim 52: the thermal barrier coating can comprise a deposited ceramic material. Column 5, lines 1-20 and column 7, lines 10-20. The CDIM can comprise lanthanum oxide. Column 5, lines 25-40 and column 7, lines 10-20.

Claim 53: the thermal barrier material can be plasma sprayed onto the substrate. Column 5, lines 1-20. The CDIM can be plasma sprayed on the layer of thermal barrier material. Column 7, lines 10-20.

Claim 54: the CDIM spraying step can be performed immediately following the thermal barrier spraying step. Figure 6, column 7, lines 10-20 and 30-45.

### *Claim Rejections - 35 USC § 103*

7. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

8. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

Art Unit: 1762

invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

9. Claims 31, 34, 35, 37, 42, 44-49 and 51 are rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian (US 6258467).

Subramanian teaches all the features of these claims, as discussed in the 35 USC 102(e) rejection using Subramanian above, except (1) the thickness of the thermal barrier material layer (claim 31, 42, 51), (2) the thickness of the CDIM layer (claim 34, 35, 42, 47, 51), (3) the use of the same deposition equipment (claim 37), (4) that the substrate is an internal wall of a combustor (claim 45).

Subramanian does teach that the substrate can be nickel or cobalt based superalloy as in claim 44. column 4, lines 35-45. The substrate can be a combustor. Column 1, lines 15-20. The layer of CDIM would inhibit the adherence of carbon nodules to the gas turbine engine surface as in claim 46 due to the use of the lanthanum oxide layer. The thermal barrier material can comprise an oxidation resistant bond coat as in claim 49. column 4, lines 50-65. As to the thickness of the thermal barrier layer, Subramanian provides that the bond coat layer, if present, can have a thickness of 1-20 mils. Column 4, lines 50-65. In a provided example, the thickness of the yttria stabilized zirconia layer on the bond coat is 225 microns or approximately 9 mils. Column 7, lines 30-45. The thickness of the oxide layer (corresponding to the location of the CDIM layer) in the example on top of the yttria stabilized zirconia layer is also 225 microns, or approximately 9 mils. Column 7, lines 30-45.

Art Unit: 1762

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian to (1) optimize the coating thickness of the thermal barrier material layer thickness to provide a thickness inside the range of 5-100 mils with an expectation of providing a desirable coated product, given the teaching in the example of using a 9 mil thick yttria stabilized zirconia ceramic layer and the further teaching of using a standard base thermal barrier coating followed by a top coating of the taught lanthanum oxide (column 7, lines 10-20) and the teaching of an optional bond layer between 1 and 20 mils thick, given a resulting indication of desirable thickness of 9-~~20~~<sup>29</sup> mils thick. It would further have been obvious to modify Subramanian to (2) optimize the coating thickness of the thermal barrier material layer thickness to provide a thickness inside the range of 1-50 mils and preferably 1-5 mils with an expectation of providing a desirable coated product, given the teaching in the example of using a 9 mil thick top oxide coating of the invention on top of a standard yttria stabilized zirconia ceramic layer giving a resulting indication of desirable thickness of 9 mils and given that one of ordinary skill in the art would optimize the thickness of the coating using the specific material (in this case the lanthanum oxide material). It would further have been obvious to modify Subramanian to (3) use the same deposition equipment to deposit both layers with an expectation of providing a desirable coated product, given the teaching in the example and at column 5, lines 1-15 and column 7, lines 10-20 of using the same type of deposition equipment for both layers, with the top layer deposited immediately on the bottom layer. The use of the same equipment would allow for efficient use of the application equipment, without have to use extra, more costly, equipment. It would further have been obvious to modify Subramanian to (4) coat the internal wall of a

Art Unit: 1762

combuster with an expectation of providing a desirable coated product, given the teaching in the of coating a combustor of a gas turbine engine in general, and that the internal wall of this combustor would be a surface to be protected since it would be exposed to the harsh engine conditions.

10. Claim 43 is rejected under 35 U.S.C. 103(a) as being unpatentable over Subramanian as applied to claims 31, 34, 35, 37, 42, 44-49 and 51 above, and further in view of Rigney et al. (US 5350599).

Subramanian teaches all the features of this claim except the substrate of a silicon carbide composite or silicon nitride.

However, Rigney teaches that it is desirable to provide a thermal barrier coating, the coating including an optional bond coat and a ceramic thermal barrier coating, on substrate used in gas turbine engines. Column 1, lines 5-20 and column 2, lines 30-60. This substrate can be made of a nickel based superalloy! Column 2, lines 30-40. The substrate can also be made of a silicon carbide composite or a silicon nitride material. See column 2, lines 30-60.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Subramanian to use of silicon carbide composite or silicon nitride material as the substrate as suggested by Rigney with an expectation of providing a desirable protected article, because Subramanian teaches a desirable protected thermal barrier coating for turbine substrates and Rigney teaches that when providing turbine substrates to be protected by thermal barrier

Art Unit: 1762

coatings it is desirable to use a nickel superalloy or silicon carbide composite or silicon nitride material.

11. Hasz et al (US 5914189) teaches that a protective material to place over thermal barrier coatings can include lanthanum oxide. See column 6, lines 25-35 and 50-60.


### *Conclusion*

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Katherine A. Bareford whose telephone number is (571) 272-1413. The examiner can normally be reached on M-F(6:30-4:00) with the First Friday Off.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Shrive P. Beck can be reached on (571) 272-1415. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 872-9306 for regular communications and for After Final communications.

Other inquiries can be directed to the Tech Center 1700 telephone number at (571) 272-1700.

Furthermore, information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

  
KATHERINE A. BAREFORD  
PRIMARY EXAMINER  
GROUP ~~1400~~ 1700